

TOTAL TEAMWORK IN TRAINING DEVELOPMENT

ABSTRACT

The FAA is planning to implement CPDLC, a new air-ground communications technology in the summer of 2002. This new technology will radically alter the way controllers and pilots communicate. Because CPDLC will affect the methods of communicating both in the air and on the ground, a new development strategy is being employed. Both flight deck and ground system experts are involved in the development process. The FAA is also incorporating all facets of the system into the training program. The result will be a better operational system being implemented, as well as a more comprehensive training program.

BACKGROUND

Air traffic controllers have communicated with aircraft using Very High Frequency (VHF) analog radios over a national network of air-ground transceivers for at least 50 years. Operationally, the demand for communications often exceeds the usable frequency capacity in areas of high air traffic density. The current infrastructure allows only one controller per sector to interact explicitly with only one aircraft at a time, which limits the delivery of clearances and advisories. Controller-Pilot Data Link Communications (CPDLC), which is part of the FAA's Aeronautical Data Link system, will provide an additional digital communications channel to supplement the voice frequencies. Multiple controllers will have the capability to send Data Link messages from any given sector to any or all Data Link equipped aircraft in that sector, and transmissions will take place

simultaneously over multiple media. This represents both a vast improvement over the current system capabilities and a different operational environment. Procedures on the flight deck and in the control room will have to be adapted to this new environment.

Development Process

Very generally speaking, a series of chronological steps is followed to field a new system or technology. First, there is a series of design activities resulting in documentation of system requirements. This step is followed by system development. Upon completion, or just prior to completion of system development, a training program is developed to teach the new equipment steps. After implementation, new procedures are developed to handle the new ways of conducting operations. These procedures are then incorporated into new or existing manuals, and briefings take place on the new procedures. While this may be an oversimplification of the process, it describes the general chronological development of a system that has often taken place in the FAA and possibly many other organizations.

Often within this process, the training development team has been handed a manual or set of specifications and sent to develop the training with the task of ensuring that the information in those documents is taught. Therefore, the training development will take place in a vacuum of sorts, separated from the operational development.

A NEW STRATEGY

In developing CPDLC, a new strategy of "build a little, test a little" is being used. The FAA is employing this strategy by developing and implementing first the foundation of CPDLC, a set of four basic services, and then building upon this foundation with additional services in later builds. Additionally, a prototype system is being tested in a simulation environment prior to the deployment of the operational system in the live environment. This prototype system has provided a baseline system upon which we have been able to build and test a training program.

In developing CPDLC training, we are employing a strategy of total inclusion of all appropriate experts and affected stakeholders. For example, in the training development process, we have included pilots, controllers, system engineers, instructional systems design specialists, developers, and human factors experts. We have also included members of the operational design team and members of the procedures development team.

Because CPDLC brings a totally new concept of teamwork to the sector by allowing multiple people to simultaneously issue clearances, we have also included studies on the teamwork aspect into the training development process. The flight deck long ago included the capability for multiple pilots to fly an aircraft, and the airlines recognized the need for teamwork training in order to manage this capability. Therefore, we have included pilots who are knowledgeable in the area of Crew Resource Management (CRM) in our development process.

Procedures Development

Unlike many other programs, we are developing procedures in tandem with the functional training, and we are integrating

procedures into the training package. To develop the procedures, we assembled a group of subject matter experts in the areas of air traffic control and the new CPLDLC system functionality. Many of these experts are also members of the Training Development Team and carry both the history and rationale of the procedural development back to the training program. The initial intent was to develop a set of procedures to use as a baseline FAA order and then bring in the airborne participants to answer questions in any of the areas that were questionable. However, at our first joint ground-airborne procedures meeting, we discovered that areas that were not originally identified as questionable created the most controversy. We then decided to include pilots in all future meetings in order to provide a constant "logic check" of the procedures being developed. As a result of this meeting, the airborne procedures development team has begun including controllers in their meetings also.

BENEFITS ANALYSIS

This inclusive approach to development has led to some additional expenses. There are additional costs associated with bringing all of the experts together regularly to review the training products. Also, building a consensus can be more challenging and time consuming due to the variety of interests represented and issues that can be raised. However, developing the training in this manner has resulted in several benefits.

Improved System Design

By including members of the operational design team, we have been able to positively impact the system design. As we repeatedly review the operational system and training materials to ensure accuracy, better or safer methods of system operation come to light. Because CPDLC is being implemented in phases, issues and concerns identified during training development of the current build can be addressed in later builds by

incorporating new or modified features. In essence, the training development process has served as a form of Beta test for this system.

Minimized Training Risk

Inclusion of both groups of system users (i.e., pilots and controllers) has allowed us to identify needed operational and procedural improvements in the early stages of training development. These changes can then be incorporated into the operational system and hence the system training. When these changes are identified early, it is usually at the cost of revising a design document, as opposed to more costly changes such as reprinting course materials or, in this case, reprogramming computer-based instruction (CBI) modules. It also allows for an improvement that can be integrated seamlessly into the course rather than just creating a "patch". By gathering the various experts together early in the design, we have developed more confidence in the ability of the training product to address all facets of the new system.

Better Procedures

By including members of the aviation industry, we have ensured that the procedures that we develop and train will be compatible with the flight deck operating methods and procedures, and that they will enhance the system usability, both in the air and on the ground.

Better Change Management

By including controllers and supervisors from the key site, and union representatives for both controllers and pilots, we have greatly increased the chances of the training program being accepted by the users. We have provided the avenue for concerns and issues to be raised and addressed prior to implementation. While it is not reasonable to expect that there will be no resistance to the changes associated with CPDLC implementation, including members of these groups should minimize the chances of overlooking key issues of concern to these users. As a result, the training development has truly been a joint effort with all groups justly claiming ownership.

SUMMARY

By employing a new strategy for the deployment of CPDLC, which involves total teamwork in the training development, the FAA is incurring higher front-end development expenses. However, this higher initial investment will result in an overall lower system development cost by reducing or eliminating last-minute implementation expenses. Also, in this era of controversial system deployment delays and cancellations, the added benefits of improved system design, minimized training risk, better procedures, and better change management are essential for the viability of this or any other program.